CSB Statement on Sugar Refinery Dust Explosion Emphasizes Need For Thorough Risk Analysis

The Chemical Safety Board issued a statement concerning the on-going investigation at the Imperial Sugar Company in Savannah, Georgia. Although it is too early to know exactly what happened, the CSB statement contains important information concerning some of the issues that must be addressed to prevent or at least mitigate the potential consequences of a dust explosion. One important aspect of explosion protection is the potential danger posed by ducts.

The CSB states: "buildings have walls, ceilings, floors and roofs, they create confinement…another form of confinement may be process equipment and even ducting. It can be ironic that ducting used for dust extraction and other equipment such as dust collectors can themselves be conducive for the initiation of dust explosions."

In other words the ducts themselves can be the locus for a dust explosion. This is true for both the ducts that connect dust collectors or cyclones to various points of extraction as well as for the duct(s) that direct explosion vent(s) to a safe location during a deflagration. The method for addressing this problem will be discussed shortly.

The CSB statement points out, too, that "An important attribute of dust explosions is that they may propagate. In such instances some primary event occurs that kicks up larger amounts of dust that may have accumulated and disperses the dust into the air. When this happens the stage can be set for catastrophe. A very large flammable dust cloud ignites with devastating consequences. In other instances an initial explosion may simply propagate as the blast wave ahead of a rapidly advancing flame front - the fireball - which disperses more dust and ignites as the fireball expands."

In this context it should be pointed out that flame spread propagation can occur inside ducts and pipes, but also it can travel in the open along floors, or across "I" Beams, or up and down stairwells, or through tunnels. As long as there is combustible dust available flame and pressure can travel and span great distances. Losses from propagation and secondary events often exceed the damage caused by the primary explosion.

The picture painted in the CSB statement is bleak, but accurate. "When a dust explosion occurs in a building, walls may blow out, floors may heave, and ceilings may collapse. This can all occur in a few seconds. It is therefore not unusual for local fire protection and electrical systems to be almost instantly crippled. Occupants may at first find themselves burned, or blown about, or struck, or among rubble. At worst they may experience all of that. At first they may find themselves in darkness or the obscurity of smoke. But fires initiated by the thermal energy of the explosion may follow and grow. The scene is set for tragedy."

To address these problems requires that a systematic assessment be made by a qualified person familiar with the dust explosion hazard. CV Technology, an international leader in explosion protection and mitigation calls the proper assessment a "Risk Analysis". Bill Stevenson is Vice President of Engineering for CV Technology and states, "Our business is planted on the principle that a Risk Analysis should form the basis for any well founded explosion prevention and mitigation plan." Stevenson illustrates the advantage of having a risk analysis performed by quoting the recent CSB statement.

Since over 50% of all dust explosions occur in dust collectors, they form a window for the purpose of demonstration. Considering that dust collectors are the locus for such a high percentage of all dust explosions it might be assumed that the explosion risk is well known and the mechanisms for protection are well understood and widely applied. Nothing could be further from the truth. For example, explosion protection can be as simple as installing an appropriately sized explosion vent panel and yet there are no national mandates forcing this to be the case. Collectors are sold every day with no explosion protection on them. Often explosion vents are installed, but the collector is installed inside the building and when, as, and if there is an explosion, the vent panel relieves directly into the work space. Suddenly, the CSB statement "When a dust explosion occurs in a building…" has new meaning.

Another potential scenario, consider a collector that is equipped with an explosion vent, the collector is located adjacent to an outside wall, and a short duct is installed to direct the hot gases and flames from the collector to a safe area outside the building. In principle this is a good way to protect, but the devil is in the details. What is on the other side of the wall? An area where workers are frequently present is not acceptable. What if the duct is not straight and short? As CSB said, the explosion duct itself can become the locus for a secondary explosion.

How is it possible to prevent this from happening?

As Stevenson points out, "A proper risk analysis not only identifies and minimizes the conditions that foster explosion, but in most cases a well formed mitigation strategy can prevent fatal injury if an explosion were to occur."

The ducts or pipes leading from various pickup points in the manufacturing process to any given dust collector not only can transfer flame and pressure very readily, but they can act as a kind of accelerator such that the longer the distance, the more severe the potential discharge flames could be. This phenomenon is known as flame jet ignition and the elevated turbulence and energy disgorged can overwhelm any explosion protection scheme. To put another way, if the pipe is long and flame spread is not stopped, even a properly protected collector would be susceptible to an explosion that would breach its container.

There are various ways and means to address these problems, but since each situation is unique it is not possible to properly cover them here. The place to seek help is with a qualified risk analysis.

CV Technology provides strategic consulting to examine the needs of each client and assess the risk of dust explosion. In addition, CV Technology manufactures products that are designed to prevent or mitigate dust explosions. Isolation Valves, Rupture Discs and Panels, and Flameless Vents are custom tailored to minimize (and in some cases prevent) any damage or other interruptions to the process if an explosion were to happen. More information and detail is available on the corporate website: www.cvtechnology.com